

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-128847

(43)Date of publication of application : 09.05.2002

---

(51)Int.Cl.

C08F291/00  
G03F 7/11  
H01L 21/28  
H01L 21/3205

---

(21)Application number : 2001-215794

(71)Applicant : SHIPLEY CO LLC

(22)Date of filing : 16.07.2001

(72)Inventor : LACHOWSKI JOSEPH F  
RUTTER EDWARD W JR  
TREFONAS PETER III  
PAVELCHEK EDWARD K

---

(30)Priority

Priority number : 2000 218235    Priority date : 14.07.2000    Priority country : US

---

### (54) BARRIER COMPOSITION

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a barrier composition to reduce or eliminate poisoning or contamination of a photoresist layer or an antireflective coating layer caused by a dielectric layer.

SOLUTION: This barrier composition contains one or more crosslinkable polymers, one or more acid catalysts, one or more crosslinking agents and one or more solvents, where at least one of the crosslinkable polymers and the crosslinking agents has one or more acid parts. The acid parts mean herein one or more acid groups contained in the crosslinkable polymers, crosslinking agents or both of them.

---

### LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

CLAIMS

---

[Claim(s)]

[Claim 1] The constituent with which it is a barrier constituent containing the polymer in which one or more bridge formation is possible, one or more acid catalysts, one or more cross linking agents, and one or more solvents, and at least one of the polymer which can construct a bridge, and the cross linking agents has one or more acid parts.

[Claim 2] The constituent according to claim 1 with which the polymer which can construct a bridge has one or more aromatic series hydroxyl compounds as a polymerization unit.

[Claim 3] The constituent according to claim 1 with which the polymer which can construct a bridge contains one or more aromatic aldehyde condensates.

[Claim 4] The constituent according to claim 1 with which an acid part does not contain a blocking radical selectively at least.

[Claim 5] The constituent according to claim 1 with which the polymer which can construct a bridge contains one or more aromatic aldehyde condensates and one or more acrylate (meta) polymers.

[Claim 6] How to be an approach of offering a barrier layer on a dielectric base, be a constituent containing the polymer in which one or more bridge formation is possible, one or more acid catalysts, one or more cross linking agents, and one or more solvents, and include the process which arranges the polymer which can construct a bridge, and the constituent with which at least one of the cross linking agents has one or more acid parts on the front face of a dielectric base.

[Claim 7] The approach according to claim 6 the polymer which can construct a bridge contains one or more aromatic series hydroxyl compounds as a polymerization unit.

[Claim 8] The approach according to claim 6 the polymer which can construct a bridge contains one or more aromatic aldehyde condensates.

[Claim 9] The approach according to claim 6 an acid part does not contain a blocking radical selectively at least.

[Claim 10] The approach according to claim 6 the polymer which can construct a bridge contains one or more aromatic aldehyde condensates and one or more acrylate (meta) polymers.

[Claim 11] The approach according to claim 6 by which a dielectric base is applied by a physical vapor deposition or chemical vacuum deposition.

[Claim 12] The approach according to claim 6 a dielectric base is an inorganic substance.

[Claim 13] The approach according to claim 6 a dielectric base contains silicon.

[Claim 14] The device which it is the device which has a dielectric layer and the barrier layer arranged on it, and this barrier layer has the polymer in which one or more bridge formation is possible as a polymerization unit, and one or more cross linking agents, and contains the polymer which can construct a bridge, and one or more polymers in which at least one of the cross linking agents has one or more acid parts, and over which the bridge was constructed.

[Claim 15] The device according to claim 14 which furthermore has a photoresist layer.

[Claim 16] The device according to claim 14 which includes further the antireflection coating arranged between a barrier layer and a photoresist layer.

[Claim 17] The device according to claim 14 with which a barrier layer has the thickness from about 200Å to about 1.5 microns.

[Claim 18] The device according to claim 14 with which a dielectric layer is applied by a physical vapor deposition or chemical vacuum deposition.

[Claim 19] The device according to claim 14 whose dielectric layer is an inorganic substance.

[Claim 20] The device according to claim 14 with which a dielectric layer contains silicon.

- [Claim 21] How to be a method including arranging a barrier layer between a dielectric layer and a photoresist layer of decreasing the contamination of a photoresist layer, and for this barrier layer have the polymer in which one or more bridge formation is possible as a polymerization unit, and one or more cross linking agents, and contain the polymer which can construct a bridge, and one or more polymers in which at least one of the cross linking agents has one or more acid parts and over which the bridge was constructed.
- [Claim 22] The approach according to claim 21 the polymer which can construct a bridge contains one or more aromatic series hydroxyl compounds as a polymerization unit.
- [Claim 23] The approach according to claim 21 the polymer which can construct a bridge contains one or more aromatic aldehyde condensates.
- [Claim 24] The approach according to claim 21 an acid part does not contain a blocking radical selectively at least.
- [Claim 25] The approach according to claim 21 the polymer which can construct a bridge contains one or more aromatic aldehyde condensates and one or more acrylate (meta) polymers.
- [Claim 26] The approach according to claim 21 a dielectric base is an inorganic substance.
- [Claim 27] The approach according to claim 21 a dielectric base contains silicon.
- [Claim 28] The approach according to claim 21 a barrier layer has the thickness from about 200Å to about 1.5 microns.
- [Claim 29] a) The process which offers a dielectric layer on a base, the polymer which can construct a bridge beyond b1, The barrier constituent with which at least one of the polymer which can construct a bridge, and the cross linking agents has one or more acid parts including one or more acid catalysts, one or more cross linking agents, and one or more solvents the process arranged on the front face of a dielectric layer, and c -- the manufacture approach of an electron device which heats a base to sufficient temperature to harden a barrier constituent selectively at least, and includes the process which forms a barrier layer.
- [Claim 30] a) The process which offers a dielectric layer on a base, the polymer which can construct a bridge beyond b1, The barrier constituent with which at least one of the polymer which can construct a bridge, and the cross linking agents has one or more acid parts including one or more acid catalysts, one or more cross linking agents, and one or more solvents A base is heated to sufficient temperature to harden a barrier constituent selectively at least. the process arranged on the front face of a dielectric layer, and c -- The manufacture approach including the process which forms a barrier layer, the process which arranges antireflection coating on the front face of d barrier layer, and the process which arranges a photoresist layer on the front face of e antireflection coating of an electron device.

---

[Translation done.]

**\* NOTICES \***

**JPO and NCIPi are not responsible for any damages caused by the use of this translation.**

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

**DETAILED DESCRIPTION**

---

**[Detailed Description of the Invention]**

[0001] Generally this invention relates to manufacture of an electron device. This invention relates to the photoresist and antireflection coating which are used in manufacture of an electron device more at a detail.

[0002] In manufacture of electron devices, such as a printed circuit board or a semi-conductor, the layer of many matter, such as a photoresist or antireflection coating, is applied on a base. A photoresist is a photographic sensitive film used for imprinting an image to a base. The coating layer of a photoresist is formed on a base and a photoresist layer is exposed by the activity radiation source through a photo mask (reticle (reticle)) next. A photo mask has other penetrable fields to an impermeable field and an impermeable activity radiation to an activity radiation. If it exposes with an activity radiation, the chemical changeover induced by the light of photoresist coating will take place, and the pattern of a photo mask will be imprinted by the wrap photoresist in a base. After exposure, a photoresist is developed, a relief image is acquired, and, thereby, alternative processing of a base is attained.

[0003] A photoresist can be either a positive type or a negative mold. or [ carrying out the polymerization of the part for these coating layers exposed with an activity radiation about almost all the negative-molds photoresist in the reaction between the optical activity compound (photoactivecompound) of a photoresist constituent, and a polymerization nature reagent ] -- or a bridge is constructed. Therefore, the exposed coating part cannot melt easily into a developer rather than an unexposed part. Although the part exposed about the positive type photoresist becomes easy to melt by the inside of a developer, an unexposed part cannot continue melting into a developer comparatively easily. It is well-known in this industry, and a photoresist constituent is Deforest and Photoresist. Materials and Processes, McGraw Hill Book Company, New York, Chapter 2, 1975 and Moreau, Semiconductor Lithography, Principles, Practices and Materials, Plenum Press, New It is indicated by York, Chapter 2, and Chapter 4 (the part all indicate a photoresist constituent, its manufacturing method, and a usage to be is referred to as a part of this invention).

[0004] The main applications of a photoresist are the activities in semi-conductor manufacture, and the object is forming beer, a trench, or structure like those combination in a dielectric layer. It is important in order that suitable photoresist processing may attain this object. Although powerful interdependence is among various photoresist processing processes, it is thought that exposure is one of the more important processes which acquires a high-resolution photoresist image.

[0005] It sets in such a process and an echo of the activity radiation between exposure of a photoresist and "poise NINGU (poisoning)" of the photoresist by the dielectric layer are harmful because of formation of detailed structure. For example, an echo of the activity radiation from the lower layer of a photoresist restrains the resolution of the image patternized in the photoresist layer in many cases. An echo of the radiation from a base / photoresist interface can fluctuate the radiation intensity in a photoresist during exposure, consequently the line width of face of a photoresist becomes an ununiformity at the time of development. Further, radiations can be scattered about all over a photoresist field without the intention to expose, and fluctuation of line width of face produces them from a base / photoresist interface also by this. Dispersion and the amount of echoes change with locations typically, consequently line width of face becomes an ununiformity further.

[0006] An echo of an activity radiation serves as a cause of the phenomenon further known for this industry as "standing wave effectiveness (standing wave effect)." In order to abolish the effectiveness of the chromatic aberration in the lens of an aligner, in a photoresist projection technique, monochrome or semi-monochromatic radiation is usually used. However, when using monochrome or semi-monochromatic radiation for photoresist exposure for an echo of the radiation in a photoresist / base interface, especially interference and destructive interference that suit in slight strength are remarkable. In such a case, the

reflected light interferes with incident light and forms a standing wave in a photoresist. Since the thin layer of a photoresist with insufficient (underexposed) exposure is formed by the pole dot of a standing wave with the big amplitude in the case of a high reflexivity base field, a problem gets worse. The layer with insufficient exposure can bar the development of a perfect photoresist, and the problem of an edge AKUI tee (edge acuity) produces it in a photoresist profile. Since the total amount of the radiation required in order to expose this will increase if the amount of photoresists increases, generally the time amount required in order to expose a photoresist is the increasing function of the thickness of a photoresist. However, in the thickness direction of a photoresist, the higher harmonic (harmonic component) which changes between maximum and the minimum value continuously is included between exposure for the standing wave effectiveness. When the thickness of a photoresist is uneven, a problem becomes still more serious and line width of face is changed.

[0007] By the orientation latest [ to a high density semiconductor device ], there is a motion which shortens wavelength of the exposure light source in the industrial world like deep ultra-violet (DUV) light (wavelength is 300nm or less), KrF excimer laser light (248nm), ArF excimer laser light (193nm), an electron ray, and soft X ray. Generally by using for image-ization of photoresist coating the light which shortened wavelength, the echo from a resist up front face and a lower base front face increases. Thus, the activity of shorter wavelength worsens the problem of the echo from a base front face.

[0008] The further approach used in order to reduce the problem of the reflected radiation was using the absorption-of-radiation layer called the top antireflection coating or TARC arranged on the absorption-of-radiation layer called the bottom product antireflection coating or BARC between a base front face and a photoresist coating layer, or the front face of photoresist coating. For example, it is reference [ No. / [the part which indicates all the acid-resisting (antihalation) constituents in these reference and the activity of those is referred to as a part of this invention] / the PCT application WO 90/No. 03598, the Europe patent application 0639941A No. 1 and U.S. Pat. No. 4910122, No. 4370405, and / 4362809 ]. Generally such BARC and a TARC layer are also indicated by reference as an acid-resisting layer or an acid-resisting constituent. Typically, such an acid-resisting constituent contains an absorption-of-radiation component or a chromophore, a polymer binder and 1, or the cross linking agent beyond it. For example, the well-known acid-resisting constituent contained epoxy-phenol binder which does not have typically free hydroxyl, or the acrylate binder which does not have an acid radical substantially.

[0009] The variation in the topography (topography) of a base also produces the problem of the echo which restrains resolution. The image on a base may scatter about or reflect a collision radiation (impinging radiation) in the direction where versatility is not controlled, and affects the homogeneity of the development of a photoresist. If the topography of a base tends to design a more complicated circuit, it will become still more complicated and the effectiveness of the reflected radiation will become still more serious. For example, especially metal INTAKONEKUTO used on many micro electro nick bases is a problem because of the topography and a high reflexivity field.

[0010] One solution of the technical problem resulting from the variation in the topography of a base is the approach of arranging a photoresist in the height same on a front face, and the approach of this is indicated by U.S. Pat. No. 4557797 (Fuller et al.). The multilayer-structure object which has the comparatively thick lower layer of Pori (methylmetaacrylate) (PMMA) is used for this approach, and it offers a flat front face, the thin middle class who is antireflection coating, and the thin upper layer which is the photoresist matter. However, this system forms as a result the thick polymer layer which must be removed. Typically, such a layer is removed by various approaches including chemical machinery polish (CMP), etching, and wet chemical \*\*. For the time amount of the addition by such clearance process, and cost, in order that a polymer layer may help subsequent clearance, a thing thin as much as possible is desired.

[0011] other solution of the technical problem accompanying the variation in the topography of a base -- Adams et al. and Planarizing AR for DUV Lithography and Microlithography 1999:Advances in Resist Technology and Processing XVI and Proceedings of SPIE vol.3678, part2, and pp849- it is indicated by 856 and 1999. This indicates the activity of the flattening antireflection coating which reduces the need of arranging a separate flattening layer between an acid-resisting layer and a base.

[0012] The activity of the photoresist layer to a dielectric layer top often brings about "poise NINGU" of a photoresist layer. This poses a problem, especially when a dielectric layer is applied by physics or chemical vacuum deposition (P/CVD). Although the theory of such poise NINGU is not understood thoroughly, such a dielectric layer may cause a remarkable photospeed shift (photospeed shift), lifting, degradation of a profile, or prohibition of the perfect dissolution in the beer field between trench daily rye NIEISHON [ in / already / an eclipse \*\*\*\*\* aperture field with a pattern, for example, a dual DAMASHIN process, ] (trench

delineation). Such poise NINGU is a problem especially when a positive type photoresist like a deep UV (DUV) photoresist is used. Although BARC offered the effective chemical barrier to the photoresist layer, such its BARC was not fully effective for offering a barrier layer to such poise NINGU by the dielectric layer.

[0013] Therefore, offering the effective barrier to the PONIZUNINGU effectiveness of the photoresist by the dielectric layer, especially the need of receiving the barrier layer which offers the front face by which flattening was carried out exist.

[0014] It was found out that this invention decreases thru/or extinguishes the contamination or the poise NINGU effectiveness of a photoresist layer by the dielectric layer. It was also found out that the constituent of this invention forms a flat front face locally substantially. Furthermore, it was found out that this invention decreases thru/or extinguishes substantially the standing wave effectiveness, the Boeing (bowing), surface corrosion, and a footing (footing).

[0015] In the 1st mode, this invention is a barrier constituent containing the polymer in which one or more bridge formation is possible, one or more acid catalysts, one or more cross linking agents, and one or more solvents, and offers the polymer which can construct a bridge, and the constituent with which at least one of the cross linking agents has one or more acid parts.

[0016] In the 2nd mode, this invention is the approach of offering a barrier layer on a dielectric base, is a barrier constituent containing the polymer in which one or more bridge formation is possible, one or more acid catalysts, one or more cross linking agents, and one or more solvents, and offers an approach including the process which arranges the polymer which can construct a bridge, and the constituent with which at least one of the cross linking agents has one or more acid parts on the front face of a dielectric base.

[0017] In the 3rd mode, this invention is a device which has a dielectric layer and the barrier layer arranged on it, and offers the device with which this barrier layer has the polymer in which one or more bridge formation is possible as a polymerization unit, and one or more cross linking agents, and contains the polymer which can construct a bridge, and one or more polymers in which at least one of the cross linking agents has one or more acid parts, and over which the bridge was constructed.

[0018] In the 4th mode, include that this invention arranges a barrier layer between a dielectric layer and a photoresist layer. It is the approach of decreasing the contamination of a photoresist layer. This barrier layer has the polymer in which one or more bridge formation is possible as a polymerization unit, and one or more cross linking agents, and the approach containing the polymer which can construct a bridge, and one or more polymers in which at least one of the cross linking agents has one or more acid parts and over which the bridge was constructed is offered.

[0019] The process to which this invention offers a dielectric layer on a base in the 5th mode, b) The polymer in which one or more bridge formation is possible, one or more acid catalysts, one or more cross linking agents, And the barrier constituent with which at least one of the polymer which can construct a bridge, and the cross linking agents has one or more acid parts including one or more solvents the process arranged on the front face of a dielectric layer, and c -- a base is heated to sufficient temperature to harden a barrier constituent selectively at least, and the manufacture approach including the process which forms a barrier layer of an electron device is offered.

[0020] The process to which this invention offers a dielectric layer on a base in the 6th mode, b) The polymer in which one or more bridge formation is possible, one or more acid catalysts, one or more cross linking agents, And the barrier constituent with which at least one of the polymer which can construct a bridge, and the cross linking agents has one or more acid parts including one or more solvents A base is heated to sufficient temperature to harden a barrier constituent selectively at least. the process arranged on the front face of a dielectric layer, and c -- The manufacture approach including the process which forms a barrier layer, the process which arranges antireflection coating on the front face of d barrier layer, and the process which arranges a photoresist layer on the front face of e antireflection coating of an electron device is offered.

[0021] The :degree-C= Celsius degree;g= gram in which the following abbreviation has the semantics of a degree as what is used through this description unless it is shown especially in others; it is an engine-speed;%wt= percent-by-weight;mol%= mol %;mJ= Miri Joule;cm2= square centimeter;L= liter;mL= milliliter around for cm= cm;\*= angstrom;rpm= 1 minute. The vocabulary "a polymer" means a dimer, a trimer, a tetramer, oligomer, a homopolymer, a copolymer, etc. The vocabulary "a monomer" means the ethylene nature or the acetylene nature unsaturated compound of arbitration by which a polymerization can be carried out. Both acrylate and methacrylate are further included [ vocabulary / "an acrylic (meta)" ] with the vocabulary "acrylate (meta)" including both an acrylic and a meta-acrylic. Similarly, the vocabulary

"acrylamide (meta)" means both acrylamide and meta-acrylamide. "Alkyl" contains a straight chain, branched chain, and a ring type alkyl group. A "cross linker" or a "cross linking agent" is used as an exchangeable thing in this description. "Aperture" means beer, trenches, and such combination. "A future (feature)" means various geometry including aperture. Unless it is shown especially in others, all amounts are percentage by weight and all ratios are weight ratios. Combination is possible for all numerical range including a boundary value.

[0022] This invention relates to offering the base which has a dielectric layer especially the dielectric layer PVD(ed) or CVD(ed), and a barrier layer. This invention relates to decreasing thru/or extinguishing poise NINGU or contamination of the photoresist by the dielectric layer, or an antireflection coating layer further. Especially this invention relates to the manufacture approach of an electron device that a photoresist, antireflection coating, or both were applied to the dielectric layer base.

[0023] The constituent of this invention is a barrier constituent containing the polymer in which one or more bridge formation is possible, one or more acid catalysts, one or more cross linking agents, and one or more solvents, and is useful as a barrier layer constituent with which at least one of the polymer which can construct a bridge, and the cross linking agents has one or more acid parts. "An acid part" means one or more acidic groups which exist in the polymer which can construct a bridge, a cross linking agent, or its both. An acid part substantial more desirable completely does not contain a blocking radical preferably selectively at least. "Excluding a blocking radical", an acid part like the ether or ester which does not form the acidic group blocked by being organic-functions-ized or reacting is said. "Excluding a blocking radical substantially", 50% or more of an acid part is organic-functions-ized, or it says the acid part which does not form the acidic group blocked by reacting. desirable -- 30% or more of an acid part -- more -- desirable -- 20% or more -- organic functions -- it is-izing and carried out and the blocked acidic group is not formed. Although a carboxylic acid, a sulfonic acid, phosphonic acid, for example, a hydroxyl compound like an aromatic series hydroxyl compound, an acid anhydride, etc. are raised as such an acid part, it is not limited to these. It is desirable that an acid part contains an aromatic series hydroxyl compound.

[0024] It is desirable that the polymer which can construct a bridge contains the monomer which has one or more acid parts as a polymerization unit, and it is more desirable that one or more aromatic series hydroxyl content monomers are included. the monomer which has an acid part in the polymer in which such bridge formation is possible -- typical -- about one to about 99-mol % -- desirable -- at least -- about three-mol % -- more -- desirable -- at least -- about five-mol % -- it exists in % of the amount of about ten mols at least further more preferably. As a polymer in which suitable bridge formation is possible, the thing containing the monomer which has about 20, 30, 40, 50, 60, 70 and 80, and a 90-mol % acid part at least as a polymerization unit is raised especially.

[0025] In this invention, the polymer and cross linking agent in which useful bridge formation is possible can also contain other functional groups. As other suitable functional groups, although an ester group, a halogen, cyano \*\* (C1-C6) ARUKOKISHI, etc. are raised, it is not limited to these. Such a polymer and a cross linking agent can also include the combination of more acid parts, for example, more aromatic series hydroxyls than 1, than 1 or aromatic series hydroxyl, and a carboxylic-acid radical.

[0026] Typically, the polymer which can construct a bridge has about 3000 or less weight average molecular weight more preferably about 5000 or less about 8000 or less. the polymer which can construct a bridge -- at least -- about 300 -- it is preferably desirable about 400 and to have about 500 weight average molecular weight at least more preferably at least. namely, especially the range of useful weight average molecular weight -- about 300 to about 8000 -- it is about 300 to about 5000 more preferably.

[0027] The polymer which can construct a bridge for this invention has small molecular weight and large molecular weight distribution. The molecular weight distribution of this invention are characterized as the polydispersed degree of a polymer, i.e., a ratio of weight average molecular weight and number average molecular weight, (Mw/Mn). the polymer of this invention -- typical -- at least 1.5 -- desirable -- at least 1.8 -- more -- desirable -- at least 2.0 -- further -- more -- desirable -- at least 2.5 -- further -- more -- at least 3.0 of a son-in-law -- it has most preferably, Mw/Mn, i.e., the polydispersed degree, of at least 3.5. the typical polydispersed degree of the polymer in which such bridge formation is possible -- 1.5 to 4 -- desirable -- 1.8 to 4 -- it is the range of 2 to 4 more preferably.

[0028] Although the polymer of the arbitration which has a polymerization unit of one or more hydroxyl content monomers like an aromatic aldehyde condensate and Pori (vinyl phenol) as a polymer in which suitable bridge formation is possible is raised, it is not limited to these. Although phenol novolak resin is mentioned as a useful aromatic series-aldehyde condensate in this invention, it is not limited to this. Such novolak resin is typically prepared by condensation with the aldehyde of a phenol, this novolak resin is still

better known, and it is Kirk. Othmer Encyclopedia of Chemical It is indicated by many periodicals containing Technology, 15 volumes, 176-208 pages, and 1968, and the publication which teaches such resin in this periodical is referred to as some of these descriptions. Although a phenol is a phenol generally because of itself formation of such phenol resin used, and not limited especially for example, other hydroxy permutation aromatic compounds like bisphenols including p-phenylphenol and 4, and 4'-isopropylidene diphenol are suitable for alkylation phenol; lists including a resorcinol; naphthol, cresol, a xylenol, and p-tert-butylphenol similarly. Cresol is mentioned as desirable phenols and such mixture is more preferably mentioned to m-cresol, m- and the mixture of p-cresol, 2, 5-xylenol, and a list. The mixture of a hydroxy permutation aromatic compound can be advantageously used in this invention.

[0029] Although the aldehyde used is formaldehyde typically, and not limited to these, an acetaldehyde, furfuraldehyde, and other aldehydes like aromatic aldehyde can also be used, for example. Desirable aromatic aldehyde has hydroxyl in the ortho position of a carbonyl group. The most desirable aromatic aldehyde is salicylaldehyde, benzaldehydes, and those mixture. As other aromatic aldehyde suitable for the object of this invention, 2-chlorobenzaldehyde, 3-hydroxyl benzaldehyde, 4-hydroxyl benzaldehyde, 2-methoxy benzaldehyde, 3-nitro benzaldehyde, etc. are raised. The mixture of an aldehyde can also be used useful in this invention. When aromatic aldehyde is mixed with formaldehyde or a formaldehyde precursor, for example, a paraformaldehyde, rather than formaldehyde, the mol of aromatic aldehyde is superfluous, it exists and exists more preferably with at least 90% of the weight of aldehyde mixture.

[0030] Typically, phenol-novolac resin is \*\*\*\*\* (ed) from the aromatic compound and aldehyde by which the hydroxyl permutation was carried out under existence of the condensation of a phenol, i.e., an acid. Although there can be less mol concentration of an aldehyde a little than the mol concentration of a phenol, it can be equivalent weight, and some [ of a phenol ] can also be superfluous without forming the resin which constructed the bridge. The ratio of a phenol and an aldehyde can change from this viewpoint from about 1.1 to 1.0 to 1.0 to 1.1. For example, refer to U.S. Pat. No. 5939511 (Zampini). general -- this invention -- setting -- such polydispersed degree of an aromatic series-aldehyde condensate useful as a polymer which can construct a bridge -- at least -- about 2.5 -- desirable -- at least -- about 3.0 -- it is about 3.5 at least more preferably.

[0031] The hydroxyl content ethylene nature or the acetylene nature unsaturated compound of arbitration is useful as a hydroxyl content monomer in this invention. Such a hydroxyl content monomer can be aliphatic series or aromatic series, and is aromatic series preferably. As a suitable hydroxyl content monomer A phenol, cresol, resorcinol, pyrogallol, a methylol phenol, Methylol cresol, methylol resorcinol, methylol pyrogallol, A hydroxyethyl phenol, a hydroxypropyl phenol, hydroxyethyl cresol, A vinyl phenol, vinyl cresol, a vinyl methoxy phenol, Hydroxyethyl (meta) acrylate, 2-hydroxypropyl (meta) acrylate, 3-hydroxypropyl (meta) acrylate, hydroxy cyclohexyl (meta) acrylate, Hydroxyphenyl (meta) acrylate, G ethylene glycol (meta) acrylate, Although screw (hydroxyethyl) itaconate, screw (hydroxyethyl) citraconate, screw (hydroxyethyl) fumarate, hydroxyethyl itaconate, an allyl compound phenol, an allyl compound methoxy phenol, allyl alcohol, vinyl alcohol, etc. are raised It is not limited to these.

[0032] the polymer which can construct a bridge for this invention -- as a polymerization unit -- one or more aromatic compounds -- for example, -- at least -- about three-mol % -- desirable -- at least -- about five-mol % -- more -- desirable -- at least -- about ten-mol % -- containing is desirable. As a desirable aromatic compound, although a phenol nature compound, a cresol compound, a resorcinol compound, a xylenol compound, etc. are raised, it is not limited to these. As a polymer in which useful bridge formation is possible, what contains about 20-mol % of an aromatic compound at least as a polymerization unit is raised especially. It is still more desirable that the polymer which can construct a bridge contains one or more aromatic aldehyde condensates.

[0033] The values of Mw/Mn of an aromatic aldehyde condensate of especially the polymer in which useful bridge formation is possible are at least 2.5 and the thing which is at least 3.0 preferably including one or more aromatic aldehyde condensates and other one or more polymers, for example, (meta), an acrylate polymer. For example, (meta), the advantage which contains a non-aromatic series polymer like an acrylate polymer with an aromatic aldehyde condensate is being, in case the etch rate of a barrier constituent is increased. It is still more desirable that the polymer which can construct a bridge for this invention does not include a sill phenylene part substantially, and it does not include a sill phenylene part more preferably.

[0034] Although an acrylic acid (meta), acrylamide (meta), alkyl (meta) acrylate, alkenyl (meta) acrylate, aromatic series (meta) acrylate, a vinyl aromatic series monomer, the thio analog of the nitrogen content compound another place, the permuted ethylene monomer are raised as a useful monomer in order to prepare the polymer which can construct a bridge for this invention, it is not limited to these. In this

invention, the mixture of an aromatic aldehyde condensate is raised as a polymer in which useful especially desirable bridge formation is possible, and they are novolak resin and one or more mixture with Pori (meta) (acrylic acid), Pori (meta) (acrylamide), Pori (alkyl (meta) acrylate), Pori (alkenyl (meta) acrylate), Pori (aromatic series (meta) acrylate), and Pori (vinyl aromatic series) especially.

[0035] Typically, in this invention, useful alkyl (meta) acrylate is alkyl (C1-C24) (meta) acrylate. As suitable alkyl (meta) acrylate, although "low cut (low cut)" alkyl (meta) acrylate, "mid cut (mid cut)" alkyl (meta) acrylate, and "high cut (high cut)" alkyl (meta) acrylate are mentioned, it is not limited to these. Typically, as for "low cut" alkyl (meta) acrylate, an alkyl group has 1-6 carbon atoms. As suitable low cut alkyl (meta) acrylate, although it passes, and KISHIRU methacrylate is mentioned to KISHIRU methacrylate and cyclo and KISHIRU acrylate and such mixture are mentioned to cyclo, they are not a methylmetaacrylate (MMA), methyl acrylate, ethyl acrylate, propyl methacrylate, butyl methacrylate (BMA), butyl acrylate (BA), isobutyl methacrylate (IBMA), and the thing limited to these.

[0036] Typically, as for "mid cut" alkyl (meta) acrylate, an alkyl group has 7-15 carbon atoms. As suitable mid cut alkyl (meta) acrylate To 2-ethyl to KISHIRU acrylate (EHA) and 2-ethyl KISHIRU methacrylate, Octyl methacrylate, decyl methacrylate, isodecyl methacrylate (it IDMA(s)) The undecyl methacrylate which uses branching (C10) alkyl isomer mixture as the base, Dodecyl methacrylate (known also as lauryl methacrylate), Although methacrylate, tetradecyl methacrylate (known also as milli still methacrylate), pentadecyl methacrylate, and such mixture are mentioned, it is not limited to these. As useful mixture, mixture [ of the dodecyl of dodecyl-pentadecyl methacrylate (DPMA), a straight chain, and branched chain, tridecyl, tetradecyl and pentadecyl methacrylate ]; and lauryl-millimeter still methacrylate (LMA) are mentioned especially.

[0037] Typically, as for "high cut" alkyl (meta) acrylate, an alkyl group has 16-24 carbon atoms. As suitable high cut alkyl (meta) acrylate, although hexadecyl methacrylate, heptadecyl methacrylate, octadecyl methacrylate, nona decyl methacrylate, KOSHIRU methacrylate, EIKO sill methacrylate, and such mixture are mentioned, it is not limited to these. Cetyl-EIKO sill methacrylate which is the mixture of hexadecyl, octadecyl, KOSHIRU, and EIKO sill methacrylate as especially useful mixture of high cut alkyl (meta) acrylate (CEMA); although the cetyl-stearyl metaacrylate (SMA) which is the mixture of hexadecyl and octadecyl methacrylate is mentioned to a list, it is not limited to these.

[0038] an above-mentioned MIDD0-cut -- and -- yes, - cut alkyl (meta) acrylate monomer is generally prepared by the standard esterification approach which used the long-chain fatty alcohol of reagent grade -- having -- these -- the alkyl group of available alcohol is 10-15 pieces or the mixture of various chain length's alcohol which it has 16-20 pieces about a carbon atom commercially. As an example of these alcohol, it is Vista. Chemical Various Ziegler catalyst-ized (Ziegler catalyzed) ALFOL alcohol from company, ALFOL1618 and ALFOL1620, Shell Chemical TA-1618 of Proctor&Gamble's and the alcohol of the natural product origin like CO-1270 are mentioned to various Ziegler catalyst-ized NEODOL alcohol from Company, i.e., NEODOL25L, and a list. [ i.e., ] Therefore, for the object of this invention, alkyl (meta) acrylate is meant with the thing also containing the mixture of the alkyl (meta) acrylate which each named alkyl (meta) acrylate product is not only included, but mainly contains the named specific alkyl (meta) acrylate.

[0039] In this invention, a useful alkyl (meta) acrylate monomer can be an independent monomer, or can be mixture with which the number of the carbon atoms of an alkyl part differs. Moreover, in this invention, useful acrylamide (meta) and a useful alkyl (meta) acrylate monomer can be permuted by arbitration. As the permutation (meta) acrylamide and the alkyl (meta) acrylate monomer of suitable arbitration, although hydroxy (C2-C6) alkyl (meta) acrylate, dialkylamino (C2-C6)-alkyl (meta) acrylate, and dialkylamino (C2-C6) alkyl (meta) acrylamide are mentioned, it is not limited to these. Especially a useful permutation alkyl (meta) acrylate monomer has one or more hydroxyls in an alkyl group, and hydroxyl is at least in beta- in an alkyl group especially (about 2-). The hydroxyalkyl (meta) acrylate monomer whose permutation alkyl group is the alkyl (C2-C6) of branched chain or a straight chain is desirable. As a suitable hydroxyalkyl (meta) acrylate monomer, although 2-hydroxyethyl methacrylate (HEMA), 2-hydroxyethyl acrylate (HEA), 2-hydroxypropyl methacrylate, 1-methyl-2-hydroxyethyl methacrylate, 2-hydroxy-propylacrylate, 1-methyl-2-hydroxyethyl acrylate, 2-hydroxy butyl methacrylate, 2-hydroxy butyl acrylate, and such mixture are mentioned, it is not limited to these. Suitable hydroxyalkyl (meta) acrylate monomers are HEMA, 1-methyl-2-hydroxyethyl methacrylate, 2-hydroxypropyl methacrylate, and such mixture. Generally the mixture of the two latter monomers is called "hydroxypropyl methacrylate" or "HPMA."

[0040] In this invention, other useful acrylate (meta) and acrylamide (meta) monomers which were permuted have a dialkylamino radical or a dialkylamino alkyl group in an alkyl group. As an example of

such permuted acrylate (meta) and acrylamide (meta) Dimethylaminoethyl methacrylate, dimethylamino ethyl acrylate, N and N-dimethylaminoethyl meta-acrylamide, N, and N-dimethyl-aminopropyl meta-acrylamide, N and N-dimethylamino butyl meta-acrylamide, N, and N-G ethylamino ethyl meta-acrylamide, N and N-diethylamino propyl meta-acrylamide, N, and N-diethylamino butyl meta-acrylamide, N-(1 and 1-dimethyl-3-oxo-butyl) acrylamide, N-(1 and 3-diphenyl-1-ethyl-3-oxo-butyl) acrylamide, N-(1-methyl-1-phenyl-3-oxo-butyl) meta-acrylamide, And 2-hydroxyethyl acrylamide, N-meta-acrylamide of aminoethyl ethylene urea, Although such mixture is mentioned to N-METAAKURIRU oxy-ethyl morpholine, N-maleimide of dimethylamino propylamine, and a list, it is not limited to these.

[0041] Other permutation (meta) acrylate monomers useful to this invention gamma-pro PIRUTORI (C1-C6) alkoxy silyl (meth)acrylate, gamma-pro PIRUTORI (C1-C6) alkyl silyl (meth)acrylate, gamma-pro PIRUJI (C1-C6) alkoxy (C1-C6) alkyl silyl (meth)acrylate, gamma-pro PIRUJI (C1-C6) alkyl (C1-C6) alkoxy silyl (meth)acrylate, BINIRUTORI (C1-C6) alkoxy silyl (meth)acrylate, BINIRUJI (C1-C6) alkoxy (C1-C6) alkyl silyl (meth)acrylate, They are silicon content monomers, such as vinyl (C1-C6) ARUKOKISHIJI (C1-C6) alkyl silyl (meth)acrylate, BINIRUTORI (C1-C6) alkyl silyl (meth)acrylate, and such mixture.

[0042] Although styrene ("STY"), alpha methyl styrene, vinyltoluene, p-methyl styrene, ethyl vinylbenzene, vinyl naphthalene, vinyl xylenes, and such mixture are contained in a vinyl aromatic series monomer useful as a partial saturation monomer of this invention, it is not limited to these. Those corresponding permutation counterparts, such as derivative; containing one or more halogen radicals, such as a halogenated derivative, i.e., a fluorine, chlorine, or a bromine, and nitroglycerine, cyano \*\* (C1-C10) alkoxy \*\* halo (C1-C10) alkyl, Caleb (C1-C10) alkoxy \*\* carboxy, amino, and an alkylamino (C1-C10) derivative, are contained in a vinyl aromatic series monomer.

[0043] In a nitrogen content compound and a thio analog useful as a partial saturation monomer of this invention Vinylpyridines, such as a 2-vinyl-pyridine or 4-vinylpyridine; 2-methyl-5-vinylpyridine, 2-ethyl-5-vinylpyridine, 3-methyl-5-vinylpyridine, 2, 3-dimethyl-5-vinylpyridine, and low-grade alkyl (C1-C8) permutation N-vinylpyridine [, such as 2-methyl-3-ethyl-5-vinylpyridine, ]; -- methylation quinoline and isoquinoline; -- N-vinyl caprolactam; -- N-vinyl butyrolactam; -- N-vinyl-pyrrolidone; -- vinyl imidazole; -- N-vinylcarbazole; -- N-vinyl succinimide; (meta) -- acrylonitrile; -- o-, m-, or p-amino styrene; maleimide;N-vinyl oxazolidone;N -- N-dimethylaminoethyl-vinyl ether; -- ethyl-2-cyanoacrylate; -- vinylacetone; -- N-vinyl phthalimide; -- an N-vinyl-thio-pyrrolidone -- A 3-methyl-1-vinyl-pyrrolidone, a 4-methyl-1-vinyl-pyrrolidone, A 5-methyl-1-vinyl-pyrrolidone, a 3-ethyl-1-vinyl-pyrrolidone, A 3-butyl-1-vinyl-pyrrolidone, 3, and 3-dimethyl-1-vinyl-pyrrolidone, A 4, 5-dimethyl-1-vinyl-pyrrolidone, 5, and 5-dimethyl-1-vinyl-pyrrolidone, 3, 3, a 5-trimethyl-1-vinyl-pyrrolidone, a 4-ethyl-1-vinyl-pyrrolidone, N-vinyl-pyrrolidone; vinyl pyrroles, such as a 5-methyl-5-ethyl-1-vinyl-pyrrolidone and 3 and 4, and 5-trimethyl-1-vinyl-pyrrolidone; although vinyl aniline; and a vinyl piperidine are contained, it is not limited to these.

[0044] this invention -- setting -- a permutation ethylene monomer useful as a partial saturation monomer -- allyl compound monomer, vinyl acetate, vinyl formamide, vinyl chloride, and vinyl fluoride, vinyl bromide, a vinylidene chloride, vinylidene fluoride, and bromination -- although a vinylidene acid is contained, it is not limited to these. The polymer which can construct a bridge exists in the amount of the broad range in the constituent of this invention. Typically, about 85% of polymers which can construct a bridge exists in about 60 to about 85% of amount preferably from about 40 of solid content.

[0045] In this invention, a useful cross linking agent is the matter of the polymer which can construct a bridge, and the arbitration which can perform acid-catalyst bridge formation. Typically, the cross linking agent of this invention has about 120dalton or the molecular weight beyond it. It is desirable that a cross linking agent performs crosslinking reaction at the temperature of about 75 to about 250 degrees C. JI-, Tori -, a tetrapod, or a higher-order polyfunctional ethylene partial saturation monomer is contained in a suitable cross linking agent. as the example of a cross linking agent useful to this invention -- trivinylbenzene, divinyl toluene, divinyl pyridine, divinyl naphthalene, and divinyl xylene; -- and -- for example Ethylene glycol diacrylate, trimethylolpropane triacrylate, The diethylene-glycol divinyl ether, a TORIBI nil cyclohexane, Allyl compound methacrylate ("ALMA"), ethylene glycol dimethacrylate "EGDMA", Diethylene-glycol dimethacrylate ("DEGDMA"), propylene glycol dimethacrylate, Propylene glycol diacrylate, trimethylolpropanetrimethacrylate "TMPTMA", A divinylbenzene ("DVB"), glycidyl methacrylate, 2,2-dimethyl propane 1, 3 diacrylate, 1, 3-butylene-glycol diacrylate, 1, 3-butylene-glycol dimethacrylate, 1,4-butanediol diacrylate, diethylene glycol diacrylate, Diethylene-glycol dimethacrylate, 1,6-hexanediol diacrylate, 1, 6-hexanedioldimethacrylate, tripropylene glycol diacrylate, Triethylene glycol

dimethacrylate, tetraethylene glycol diacrylate, Polyethylene-glycol 200 diacrylate, tetraethylene glycol dimethacrylate, Polyethylene glycol dimethacrylate, ethoxyl-ized bisphenol A diacrylate, Ethoxyl-ized bisphenol A dimethacrylate, polyethylene-glycol 600 dimethacrylate, Pori (butanediol) diacrylate, a pentaerythritol thoria chestnut rate, Trimethylolpropane triethoxyacrylate, glyceryl propoxy thoria KURIRETO, Pentaerythritol tetraacrylate, pentaerythritol tetra-methacrylate, Dipentaerythritolmonohydroxypentaacrylate, a divinyl silane, A TORIBI nil silane, a dimethyl divinyl silane, divinyl methylsilane, A methyl TORIBI nil silane, a diphenyl divinyl silane, divinyl phenylsilane, TORIBI nil phenylsilane, a divinyl methylphenyl silane, a tetravinyl silane, Dimethyl vinyl disiloxane, Pori (methylvinyl siloxane), Pori (vinyl hydronalium siloxane), Although Pori (phenyl vinyl siloxane), tetramethoxy glycoluryl, tetrapod (C1-C8) alkoxy glycoluryl like tetra-butoxy glycoluryl, and such mixture are raised, it is not limited to these.

[0046] The cross linking agent of this invention exists in the amount of the broad range in the constituent of this invention. Typically, about 25% of cross linking agents exists [ 10 / about ] in about 15 to about 25% of amount more preferably about 30% from about 1 of solid content. In this invention, a useful acid catalyst is the thing of the arbitration which can carry out the catalyst of the crosslinking reaction of the barrier layer constituent of this invention, and a free acid (free acid) and an acid formation agent (acid generator) are raised. As an example of a free acid, although methansulfonic acid, ethane sulfonic acid, a propyl sulfonic acid, a phenyl sulfonic acid, toluenesulfonic acid, dodecylbenzenesulfonic acid, and trifluoro methylsulfonic acid are raised, it is not limited to these.

[0047] As an acid formation agent, a heat acid formation agent (TAG), photograph acid formation agents (PAG), and those mixture are raised. The heat acid formation agent and photograph acid formation agent of arbitration are useful in this invention. A heat acid formation agent is the compound of the arbitration which separates an acid by heat treatment. As a suitable heat acid formation agent, although 2, 4, 4, 6-tetrabromo cyclohexa JIENON, benzoin tosylate, 2-nitrobenzyl tosylate and the alkyl ester of other organic sulfonic acids, and the amine salt of a sulfonic acid, for example, the amine salt of dodecylbenzenesulfonic acid, are raised, it is not limited to these. Generally activation, i.e., the thing which generates a sulfonic acid by exposure to heat, is desirable. A photograph acid formation agent is a compound which separates an acid by the photolysis. As a suitable photograph acid formation agent, it is onium salt and halogenation nonionic photograph acid formation agent, 1 [ for example, ], and 1-screw (p-chlorophenyl). - Although 2, 2, and 2-trichloroethane and a fluoro alkyl sulfonic acid like a perfluoro-octyl sulfonic acid are raised, it is not limited to these.

[0048] 8% of acid catalysts exists preferably in the constituent of this invention typically in about 0.5 to about 5% of amount of solid content from about 0.1 of sufficient amount, for example, solid content, to carry out the catalyst of the desired crosslinking reaction. It is desirable in this invention to use the combination of an acid catalyst. As a suitable combination, a free acid and a heat acid formation agent are raised to a free acid, a photograph acid formation agent, and a list. Generally it is known, such an acid catalyst is commercially available, and it can be used, without refining further.

[0049] The constituent of this invention contains one or more solvents. The solvent of the arbitration of compatibility with a compound is suitable. The solvent of hypoviscosity is desirable. As a suitable solvent, for example Propylene glycol methyl ether acetate, 2-heptanone, ethyl lactate, or one or more glycol ether, For example, 2-methoxy ethyl ether (jig lime), ethylene glycol monomethyl ether, Propylene glycol monomethyl ether; The solvent which has both an ether part and a hydroxy part, For example, methoxybutanol, an ethoxy butanol, methoxy propanol, And ethoxy propanol; Ester, for example, methyl-cellosolve acetate, Ethylcellosolve acetate, propylene-glycol-monomethyl-ether acetate, Although dipropylene-glycol-monomethyl-ether acetate and other solvents, for example, dibasicity ester, propylene cull BONETO, a gamma-butyrolactone, etc. are raised, it is not limited to these. this invention -- setting -- especially a useful suitable solvent -- a comparison -- it is the high boiling point, i.e., the solvent which has at least preferably about 170 degrees C of about 190-degree C boiling points at least. The mixture of a solvent can also be used useful in this invention. That is, the solvent of this invention is mixable with other one or more solvents. Such other solvents can be a high-boiling point or a low-boiling point. When two or more solvents are used, it is desirable that at least one solvent has the boiling point of the range of about 75 to about 200 degrees C. When two or more solvents are used, it is desirable that at least one solvent has less than about 200 boiling point, and has the boiling point when other at least one solvent is more expensive than about 200 degrees C.

[0050] Although the constituent of this invention is not limited to arbitration by other one or more components and these, it can contain a plasticizer, a surfactant, a lubricating agent, a color, a chromophore,

a pigment, etc., for example. A plasticizer can be added to the constituent of this invention in order to improve the specific property of a constituent. Although dibasic ester like a dimethyl horse mackerel peat and dimethyl succinate is raised as a suitable plasticizer, it is not limited to these. The mixture of a plasticizer can be used in this invention. Typically, a plasticizer is preferably used in about 1 to about 5% of amount about 10% from about 0.5 of solid content. It is desirable that one or more plasticizers are used in this invention. up to about 50% of solid content -- since -- it is understood by this contractor that a lot of plasticizers like about 100% are used useful in this invention -- I will come out. As for a plasticizer, it is desirable that it is a liquid.

[0051] As a surface active agent of arbitration, although a nonionic surfactant, cationic surface active agents, and those mixture are raised, it is not limited to these. That to which especially a suitable surfactant is sold from a fluorination surfactant, for example, 3M company, is raised. A surfactant is typically used in about 0.1 to about 1.0% of the weight of the range.

[0052] It is surface leveling agents including what is available as a trade name Silwet7604 from Witco as an advantageous leveling agent in this invention, or 3M. The available surfactant FC430 is mentioned from Company. Selection and the amount of such a leveling agent are the matter of this contractor's capacity within the limits. Typically, such a leveling agent is used in about 0.1 to about 2% of amount of the total solid content.

[0053] The constituent of this invention can act also as antireflection coating. For example, when the polymer and/or cross linking agent which can construct a bridge contain an aromatic series radical, such a constituent can be used as an acid-resisting constituent to 193nm radiation. As an exception method, a color or a chromophore can be added to the constituent of this invention by copolymerization or mixing, and a useful acid-resisting constituent can be offered in the radiation of other wavelength. For example, sufficient chromophore for the polymer and/or cross linking agent which can construct a bridge is made to contain, and about 0.3 to about 0.8 optical density can be obtained in the exposure wavelength used for the photoresist layer applied succeedingly. As an exception method, a chromophore like an anthracene compound can be directly added to the constituent of this invention.

[0054] The concentration of the concentration of the desiccation component in a solvent, i.e., the polymer in which one or more bridge formation is possible, one or more acid catalysts, and one or more cross linking agents changes according to the factor of many like the method of application. Generally, the solid content content of the constituent of this invention is about 0.5 to 25 of the sum total weight of a constituent % of the weight, and a solid content content is about 2 to 20 of the sum total weight of a constituent % of the weight preferably. The constituent of this invention is prepared by combining a component in order of arbitration.

[0055] The constituent of this invention is useful as a barrier layer on a base, especially a dielectric layer base in manufacture of an electron device, for example, a semi-conductor, a conductor, an integrated circuit, a printed circuit board, etc. The constituent of this invention is useful especially in manufacture of a semiconductor device like the wafer used in manufacture of a semi-conductor. The constituent of this invention is applicable to a base by the various approaches of arbitration like for example, spin coating. In case it applies to a base, the constituent of this invention offers coating or the layer arranged on a base front face. For example, when a constituent is applied to a semi-conductor wafer by spin coating, about 1.5 microns of thickness of the film obtained can be preferably controlled in about 200A to about 1.5 microns from less than about 200A. Typically, about 1600A of barrier constituents of this invention is preferably applied in an about 600 to 1200A layer from about 600.

[0056] That is, this invention is the approach of offering a barrier layer on a dielectric base, is a barrier constituent containing the polymer in which one or more bridge formation is possible, one or more acid catalysts, one or more cross linking agents, and one or more solvents, and offers an approach including the process which arranges the polymer which can construct a bridge, and the constituent with which at least one of the cross linking agents has one or more acid parts on the front face of a dielectric base.

[0057] In the photoresist of arbitration by the dielectric layer of arbitration, and the dielectric layer by which PVD(ing) or CVD deposition was carried out preferably, or contamination of antireflection coating, the barrier layer of this invention is advantageously used, reduction thru/or in order to lose. As a suitable dielectric layer, an inorganic dielectric layer, organic dielectric layers, and such mixture are raised, and it is an inorganic dielectric layer preferably. As a suitable inorganic dielectric layer, although silicon content dielectric layers, such as a silica, SHIRUSE float oxane (silsesquioxanes), alkoxysilane by which condensation was carried out selectively, and silicate by which refining was carried out organically, are raised, it is not limited to these. Various organic dielectric matter can also be used in this invention.

[0058] Typically, a bridge is selectively constructed over the constituent of this invention at least by heating about 250 degrees C at about 90 to about 225 degrees C preferably from about 75. The thing of a barrier constituent for which a bridge is constructed over about 10% at least is said [ "a bridge is constructed selectively at least" and ]. It is desirable that a bridge is substantially constructed over a barrier constituent, and a bridge is more preferably constructed over it thoroughly. The constituent of this invention can be hardened by presenting one process or 2 process baking with the base by which coating was carried out with the constituent. The constituent of temperature and a period sufficient in 1 process baking to construct a bridge in a constituent substantially preferably selectively at least, and this invention is heated. As an exception method, although 2 process baking is not enough to construct a bridge in a constituent, it heats to the 1st temperature which is made to carry out a reflow of the constituent and improves smooth nature, and the constituent of the 2nd sufficient temperature and a sufficient period to construct a bridge in a constituent substantially preferably selectively at least subsequently, and this invention is heated.

[0059] Generally, the constituent of this invention is more preferably hardened [ 15 / about / 30 / about ] for about 60 seconds further more preferably for about 120 seconds for about 120 seconds for about 360 seconds from about 15. It will be understood by this contractor that the concrete setting time changes with whenever [ class / of cross linking agent /, amount / of a cross linking agent /, amount / of an acid catalyst /, and stoving temperature ] etc. This invention is a device which has further a dielectric layer and the barrier layer arranged on it, and offers the device with which this barrier layer has the polymer in which one or more bridge formation is possible as a polymerization unit, and one or more cross linking agents, and contains the polymer which can construct a bridge, and one or more polymers in which at least one of the cross linking agents has one or more acid parts, and over which the bridge was constructed. In such a device, it is desirable that the photoresist layer is arranged on a barrier layer. It is still more desirable that an acid-resisting constituent is arranged between a barrier layer and a photoresist layer.

[0060] In manufacture of an electron device, especially a semi-conductor wafer, a dielectric layer is often applied by a physical vapor deposition (PVD) or chemical vacuum deposition (CVD). Because of continuing etching and a metallization process, eclipse \*\*\*\*\* with a pattern is required for these dielectric layers. Such pattern NINGU is attained by the activity of a photoresist and is often used with antireflection coating. Application of the layer of the barrier constituent of this invention before applying a photoresist layer, and the application before applying antireflection coating preferably decrease or lose poise NINGU or contamination of a photoresist layer by the dielectric layer.

[0061] Poise NINGU or contamination of a photoresist layer is proved by reduction of the resolution of a future. For example, drawing 1 is the cross-section photograph of scanning electron microscope (SEM) \*\* of the contact hole in the dielectric layer formed without using a barrier layer. The remarkable Boeing in the pars basilaris ossis occipitalis of a contact hole is clearly seen in this drawing. When the barrier layer of this invention is used, it decreases greatly or poise NINGU or contamination of a photoresist layer is canceled so that it may be shown by the Boeing. Drawing 2 is the cross-section photograph of the scanning electron microscope (SEM) of the contact hole in the dielectric layer formed using the barrier layer of 600A this invention. As compared with drawing 1, reduction of the amount of the Boeing in the pars basilaris ossis occipitalis of a contact hole is seen clearly. If the barrier layer of this invention becomes thicker, such poise NINGU or contamination will decrease further. 5 is the cross-section photograph of the scanning electron microscope (SEM) of the contact hole in the dielectric layer formed using thickness (1000A, 1500A, and 2000A) of the barrier layer, respectively from drawing 3. As shown in drawing 2 thru/or 5, the barrier layer of this invention decreases poise NINGU or contamination of a photoresist layer notably so that it may be shown by the Boeing.

[0062] The polymer for which this invention constructs [ the process which offers a dielectric layer on a base and ] beyond b1 a bridge, The barrier constituent with which at least one of the polymer which can construct a bridge, and the cross linking agents has one or more acid parts including one or more acid catalysts, one or more cross linking agents, and one or more solvents the process arranged on the front face of a dielectric layer, and c -- a base is heated to sufficient temperature to harden a barrier constituent selectively at least, and the manufacture approach including the process which forms a barrier layer of an electron device is offered. Typically, a photoresist layer is arranged on the front face of a barrier layer. It is desirable that antireflection coating is arranged between the front face of a barrier layer and the front face of a photoresist layer. It is still more desirable that a photoresist layer contains a positive type photoresist.

[0063] The polymer for which this invention constructs [ the process which offers a dielectric layer on a base and ] beyond b1 a bridge, The barrier constituent with which at least one of the polymer which can construct a bridge, and the cross linking agents has one or more acid parts including one or more acid

catalysts, one or more cross linking agents, and one or more solvents A base is heated to sufficient temperature to harden a barrier constituent selectively at least. the process arranged on the front face of a dielectric layer, and c -- The manufacture approach including the process which forms a barrier layer, the process which arranges antireflection coating on the front face of d barrier layer, and the process which arranges a photoresist layer on the front face of e antireflection coating of an electron device is offered.

[0064] When the barrier layer of this invention is used without using antireflection coating, a barrier layer is more desirable about 1000Å at least, and it is desirable to have the thickness of about 1500Å at least further more preferably about 1200Å at least. When antireflection coating is arranged between a barrier layer and a photoresist layer, it is desirable that a barrier layer has at least more preferably about 400Å of thickness of about 600Å at least. About 2000Å of the typical range of about 2500Å of the thickness of the barrier is about 800 to 1500Å more preferably in about 600 from about 400. Generally, antireflection coating has preferably about 2000Å of thickness of about 400 to about 1600Å from about 200. Generally a photoresist layer has preferably about 10000Å of thickness of about 500 to about 7500Å from about 200.

[0065] The advantage of the constituent of this invention is that they are a photoresist, and the dielectric and spin ball compatibility (spin bowl compatible). [ SUPINON / compatibility ] Although this invention was explained about semi-conductor manufacture, this invention can be used in a broad application. The following examples do not illustrate the various modes of this invention, and do not restrict the range of this invention at all.

[0066] the :metacresol-Parakou resol -2 by which the example 1 barrier layer constituent was prepared by combining the following, and 5-dimethoxy phenol novolak polymer (the solution of 30% of solid content in propylene-glycol-monomethyl-ether acetate (PGMEA) --) 301.268g and 75.95% of solid content, Mn800, Mw2500 g/mol, Tg83 degree C; 9.520g of dodecylbenzenesulfonic acid blocked as a heat acid formation agent, King Industries, Norwalk, and Connecticut -- since -- Nacure5225 sold and 25% solid content in isopropanol -- 2% of solid content; it is tetra-butoxy glycoluryl (26.180g) as a cross linking agent. 22% of solid content; surface activity lubricating agent FC430 (it is sold from 3M, Minneapolis, and Minnesota) 1% solution in PGMEA, 5.950g, 0.05% of solid content; dimethyl horse mackerel peat (5.950g, 5% of solid content which does not contain this);, and 322.512g of PGMEA. This obtained sample of 17% of solid content 700g. enough to dissolve the matter in a constituent -- carry out a time amount roll (roll) and let the 0.2-micron Pori (tetrafluoroethylene) (PTFE) filter pass before an activity -- it passed.

[0067] It is called four wafers (sample 1-4) containing an example 2 P/CVD dielectric layer. Mark8 was used and the spin coat was carried out by various thickness with the barrier constituent of an example 1. The constituent was baked for 60 seconds at 195 degrees C. Spin coating of the commercial antireflection coating (AR7, Shipley Company, Marlborough, product made from Massachusetts) was carried out on the front face of the hardened barrier constituent, and it considered as the thickness of 600Å, subsequently it baked for 60 seconds at 175 degrees C, and the film was hardened. Spin coating was carried out by the same thickness various with AR7 antireflection coating, and four wafers (comparison sample C1-C4) which have the same P/CVD dielectric layer were baked on the same conditions. These comparison samples do not contain the barrier constituent. Spin coating of all the wafers was carried out by the commercial photoresist (UV210, product made from Shipley Company). Coating of the photoresist was carried out to the thickness of 5000Å, and it was baked for 60 seconds at 130 degrees C. Subsequently, the wafer used ASML 5500/200, and exposed it by 25 mJ/cm<sup>2</sup> to 33 mJ/cm<sup>2</sup>, and the trench whose aspect ratio is 200nm of 1:2 was prepared. Succeedingly, at 130 degrees C, the wafer was baked for 90 seconds to exposure, and, subsequently was developed to it. A result is shown in a table 1.

[0068]

[A table 1]

表 1

サンプル	バリア組成物 厚さ (Å)	反射防止コーティング 厚さ (Å)	露光結果
1	1300	600	イメージされた
2	1000	600	イメージされた
3	700	600	イメージされた
4	400	600	イメージされた
C-1	0	1300	イメージされなかった
C-2	0	1000	イメージされなかった
C-3	0	1600	ほとんど識別できない イメージであった
C-4	0	1900	イメージされたが、最小 照射量ではなかった

[0069] The above-mentioned data show clearly that it is effective in the barrier constituent of this invention decreasing in number or preventing poise NINGU or contamination of a photoresist layer by the dielectric layer. Furthermore, in case the constituent of this invention is used, the thickness of an antireflection coating layer can be decreased.

[0070] The spin coat of the four wafers (sample 5-8) which have example 3P / CVD dielectric layer was carried out by thickness various with the barrier constituent of an example 1. The constituent was baked for 60 seconds at 205 degrees C. Spin coating of the commercial antireflection coating (AR3, product made from Shipley Comapany) was carried out on the front face of the hardened barrier constituent, and it considered as the thickness of 600A, subsequently it baked for 60 seconds at 205 degrees C, and the film was hardened. Similarly spin coating was carried out by the thickness of 600A by AR3 antireflection coating, and one wafer (comparison sample C5) which has the same P/CVD dielectric layer was baked on the same conditions. These comparison samples do not contain the barrier constituent. Spin coating of each wafer was carried out by the commercial photoresist (UV200, product made from ShipleyCompany). Coating is carried out to the thickness of 5000A, and a photoresist is a pro squeak tee. The hot plate (proximity hotplate) was used and it was baked for 60 seconds at 140 degrees C. Subsequently, the wafer was exposed using ASML 5500/300, and prepared the 0.22-micron contact hole. They are 90 seconds and a pro squeak tee at 140 degrees C about a wafer succeedingly to exposure. It baked using the hot plate and, subsequently negatives were developed. The scanning electron microscope (SEM) estimated the wafer after development. Drawing 15 shows the sectional view of the formed contact hole. Exposure conditions and a result are shown in a table 2.

[0071]

[A table 2]

表 2

サンプル	バリア組成物 厚さ (Å)	$E_0$ (mJ/cm <sup>2</sup> )	$E_s$ (mJ/cm <sup>2</sup> )	図
5	600	5.0	33.0	2
6	1000	5.0	29.5	3
7	1500	5.0	34.5	4
8	2000	5.0	33.0	5
C-5	0	5.9	-	1

[0072] The activity of the barrier constituent of this invention offers a contact hole with little a good sidewall profile (sidewall definition) and the Boeing as compared with what was formed without using a barrier constituent. For example, drawing 1 is the cross-section photograph of the contact hole by the comparison sample C-5, and this shows the remarkable Boeing. By contrast, drawing 25 is the cross-section photograph of the contact hole formed using the barrier constituent of this invention. These photographs show clearly that a contact hole has a good sidewall profile and has little Boeing intentionally.

---

[Translation done.]

## BEST AVAILABLE COPY

### \* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

### DRAWINGS

---

[Drawing 1]

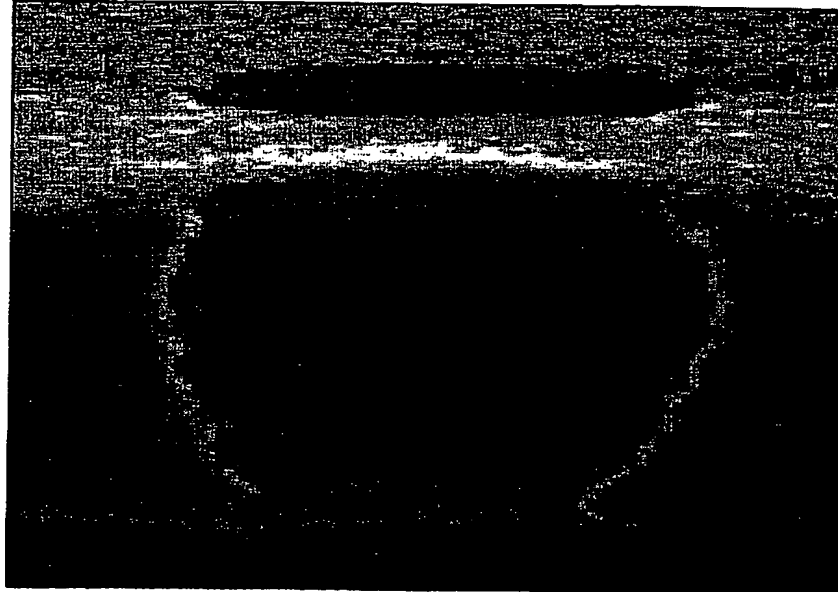


図 1

[Drawing 2]

**BEST AVAILABLE COPY**

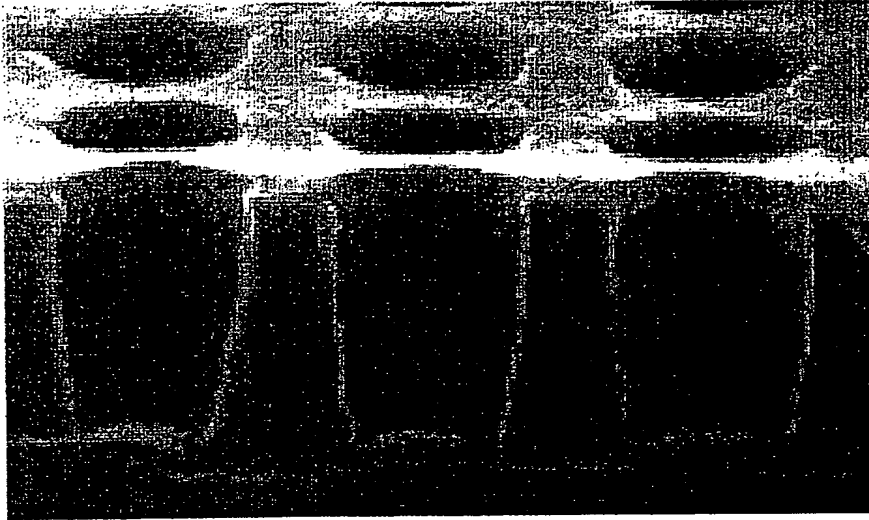


図 2

[Drawing 3]

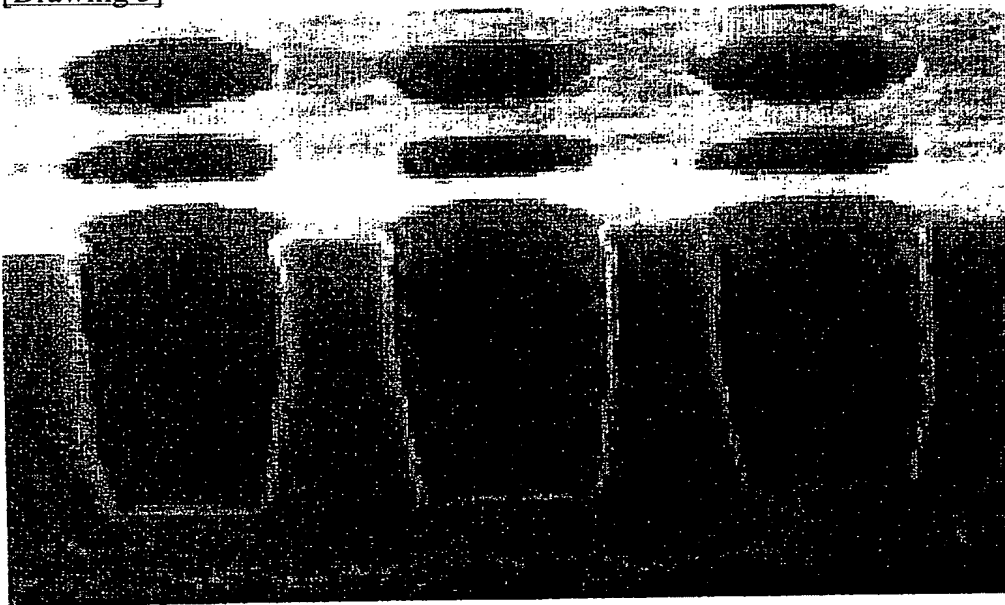


図 3

[Drawing 4]

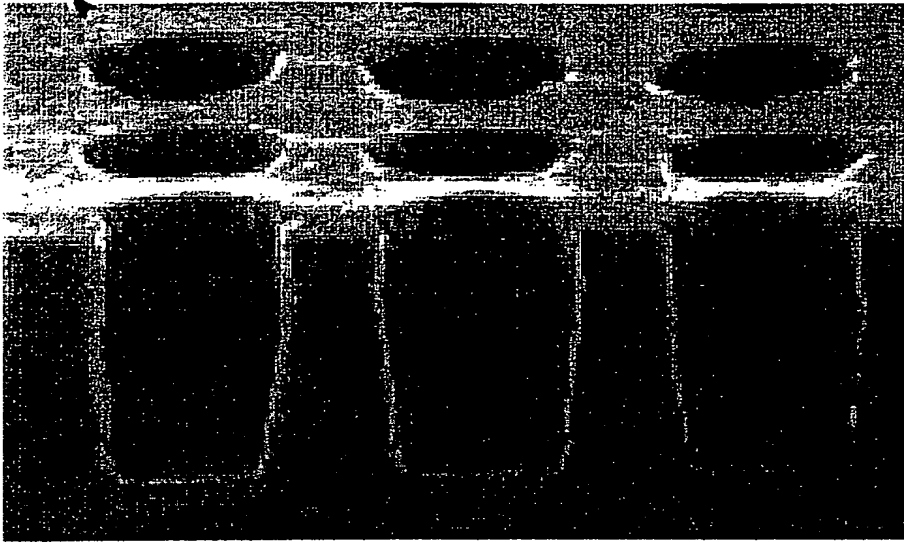


図 4

[Drawing 5]

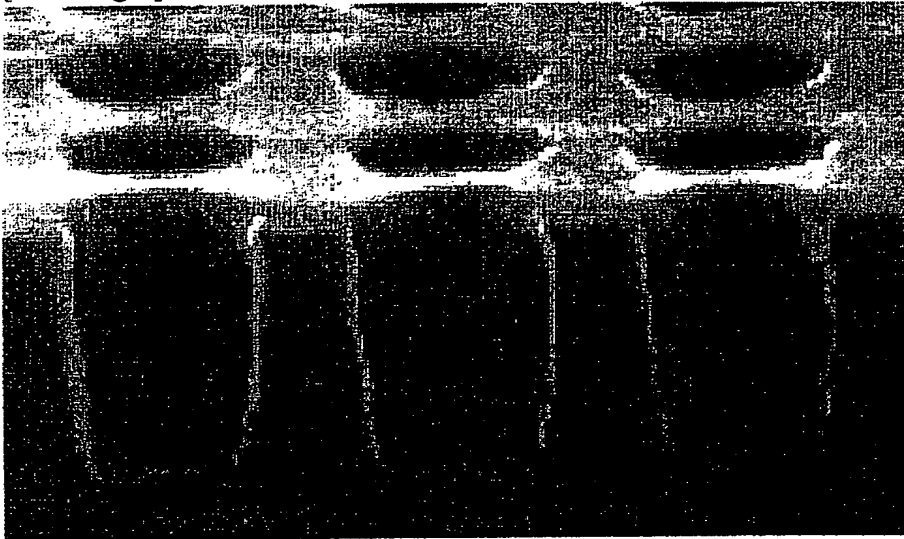


図 5

BEST AVAILABLE COPY

---

[Translation done.]